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## PATENT SPECIFICATION

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### COMPLETE SPECIFICATION

#### Improvements in or relating to Cam Gearing

We, REGINALD BISHOP, of 145 The Vale, Golders Green, London, N.W.11, England, and ROBERT HENRY JOHNSTON, of Flowton Priory, Harpenden, Hertfordshire, England, both British Subjects, do hereby declare the invention for which we pray that a Patent may be granted to us and the method by which it is performed, to be particularly described in and by the following statement:—

This invention relates to cam gearing of the kind (hereinafter referred to as of the kind specified) comprising a cam, constituted of a worm, fixed on an operating shaft and engaged by a follower, constituted of one or more pins mounted on a rocker arm, carried by a rocker shaft, in such manner that the follower-pin or pins is or are angularly movable parallel to the side of the cam, the said pin or pins having a cam-engaging forward end and being rotatably mounted in the rocker arm by means of a front bearing adjacent this forward end. Examples of such gearing are shown and described in Specifications Nos. 568,613, and 636,826 and 663,297.

In such gearing the front bearing, which is preferably a rolling friction bearing, is accommodated in the thickness of the rocker arm which must be of correspondingly large dimensions at least at its free end so that a relatively large forging is required for the rocker arm. Generally, a rear bearing for each follower-pin is provided which bearing is also accommodated in the thickness of the rocker arm.

The rocker arm is usually forged integrally with the rocker-shaft which is intended to be rotatably mounted in a bearing provided in the housing of the gearing. When a boss is formed integrally with the rocker arm or this is otherwise thickened in order to accommodate the front bearing, it is not possible to produce the required finished surface along the whole length of the rocker shaft so that the latter must necessarily overhang the bearing in the

housing and the thrust due to the engagement of the follower pin with the cam is not taken up in the most effective manner. 50

It is an object of the present invention to provide an improved construction of gearing of the kind specified which shall not be subject to the disadvantages mentioned and shall have added advantages. 55

According to the invention in a gearing of the kind specified, the operative portion of the front bearing is disposed externally of the rocker arm. Preferably, the operative portion which may be the outer race of a rolling-friction bearing is formed integrally with a positioning portion of smaller external diameter which is engaged, for example as a press fit, in a socket formed in the rocker arm, the operative portion bearing against that face of the rocker arm which is adjacent to the cam. 60 65

One form of the invention will now be described by way of example, and with reference to the accompanying drawing which is a part sectional view of a gear having a single follower-pin. 70

In the example chosen the follower-pin has a cylindrical rear end 1 rotatably fitted into a plain rear bearing sleeve 2 and an operative forward end 3, which is of frusto-conical form, arranged to project beyond the rocker arm 4 to engage with the cam 5. Between the forward and rear ends of the follower-pin is a neck portion 6 and a frusto-conical portion 7. The neck portion 6 is grooved circumferentially at 8 and acts as the inner race for the balls or rollers 9 of a rolling-friction bearing indicated generally at 10 constituting the front bearing for the pin. The outer race 11 of this front bearing is formed in one piece with the rear bearing sleeve 2 which is of smaller external diameter than the race 90 and is pressed into a cylindrical socket 12 formed in the rocker arm 4, towards its outer end. The surface of the step 13 between the outer race 11 of the front

bearing and the sleeve 2 rests on and is supported by the front face of the rocker arm 4.

- 5 The rear end 1 of the follower-pin is capable of rotating within a plain bearing surface formed by a cylindrical bore 14 in the rear end of the bearing sleeve 2. This bore 14 widens progressively towards the front end of the bearing sleeve 2 in the form of a frusto-conical bore 15 of circular cross-section. The diameter of this cross-section being slightly greater than the corresponding diameter of the frusto-conical portion 7 of the follower-pin so that this latter fits therein with clearance.

- 15 The front end of the frusto-conical bore 15 is enlarged to form a shoulder 16 and a groove 17 is formed in the circumferential wall of this enlarged end to provide the bearing surface of the outer race 11.

- 20 The edge of the outer end of the rocker arm 4 does not extend to any substantial degree beyond the outer edge of the outer race 11 of the front bearing and, further the thickness of the rocker arm 4 does not exceed the length of the rear bearing sleeve 2 pressed therein. This results in a saving of material and a diminution in the weight of the unit, and also in a saving in space as the housing 18 of the unit, which must be sufficiently large to permit rocking of the rocker arm 4 about the axis of the rocker shaft 19, need only just clear the outer end of the rocker arm 4. Also, as the rocker arm 4 is comparatively thin and has no boss formed thereon, it is possible to produce a finished bearing surface along substantially the whole length of the rocker shaft 19. The latter may, therefore, be surrounded and supported by the usual rocker shaft bearing 20 substantially up to the inner face of the rocker arm 4, only sufficient clearance between the end of the rocker shaft bearing 20 and the rocker arm 4 being required to permit rotation of the latter about the rocker shaft axis. This

construction results in an increased rigidity of structure and also in a reduction in the length of the rocker shaft 19 for a given bearing surface.

The follower-pin is held in position at its rear end, which extends beyond the rear face of the rocker arm 4 and the plain rear bearing sleeve 2, by a spring ring 21 which encircles the rear end portion 1 and bears against the rear face of the rear bearing sleeve 2 and against a cir-clip 22 which fits into a groove 23 formed around the periphery of that part of the rear end portion 1 which extends beyond the rear face of the rocker arm 4.

What we claim is:—

1. A gear of the kind specified wherein the operative portion of the front bearing is disposed externally of the rocker arm.

2. A gear according to claim 1 wherein the operative portion of the front bearing is formed integrally with a positioning portion of smaller external diameter which is engaged in a socket formed in the rocker arm.

3. A gear according to claim 2 wherein the operative portion of the front bearing bears against that face of the rocker arm which is adjacent to the cam.

4. A gear according to claim 2 or 3 wherein the positioning portion of the front bearing includes a rear bearing for the follower-pin.

5. A gear according to any one of the preceding claims wherein the operative portion of the front-bearing is constituted by the outer race of a rolling-friction bearing.

6. A gear of the kind specified constructed arranged and adapted to operate substantially as herein described and as illustrated in the accompanying drawing.

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## PROVISIONAL SPECIFICATION

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We, REGINALD BISHOP, of 145 The Vale, Golders Green, London, N.W.11, and ROBERT HENRY JOHNSTON, of Flowton Priory, Harpenden, Hertfordshire, both British Subjects, do hereby declare this invention to be described in the following statement:—

- This invention relates to cam gearing of the kind (hereinafter referred to as of the kind specified) comprising a cam, constituted of a worm, fixed on an operating shaft and engaged by a follower, constituted of one or more pins mounted on a rocker arm, carried by a rocker shaft, in such

manner that the follower-pin or pins is or are angularly movable parallel to the side of the cam, the said pin or pins having a cam-engaging forward end and being rotatably mounted in the rocker arm by means of a front bearing adjacent this forward end. Examples of such gearing are shown and described in Specifications Nos. 568,613, and 636,826 and in the Specification of Application No. 10045,49 (Serial No. 663,297).

In such gearing the front bearing, which is preferably an anti-friction bearing, is accommodated in the thickness of the

rocker arm which must be of correspondingly large dimensions at least at its free end so that a relatively large forging is required for the rocker arm. Generally, 5 a rear bearing for each follower-pin is provided which bearing is also accommodated in the thickness of the rocker arm.

The rocker arm is usually forged integral- 10 ly with the rocker-shaft which is intended to be rotatably mounted in a bearing provided in the housing of the gearing. When a boss is formed integrally with the rocker arm or this is otherwise thickened 15 in order to accommodate the front bearing, it is not possible to produce the required finished surface along the whole length of the rocker shaft so that the latter must necessarily overhang the bearing in the 20 housing and the thrust due to the engagement of the follower pin with the cam is not taken up in the most effective manner.

It is an object of the present invention to provide an improved construction of 25 gearing of the kind specified which shall not be subject to the disadvantages mentioned and shall have added advantages.

According to the invention in a gearing 30 of the kind specified, the operative portion of the front bearing is disposed externally of the rocker arm. Preferably, the operative portion which may be the outer race of an anti-friction bearing is formed integrally 35 with a positioning portion of smaller external diameter which is engaged, for example as a press fit, in a socket formed in the rocker arm, the operative portion bearing against that face of the rocker arm 40 which is adjacent to the cam.

One form of the invention will now be described by way of example, the form chosen for illustration being one which has a single follower-pin.

45 In a gear of the kind specified the follower pin has its cylindrical rear end rotatably fitted into a plain rear bearing sleeve and its operative forward end, which is of frusto-conical form, arranged

to project beyond the rocker arm to engage 50 with the cam. Between the forward and rear ends of the follower pin is a neck portion which acts as the inner race for the balls or rollers of an anti-friction bearing constituting the front bearing for the pin. 55 The outer race of this front bearing is formed in one piece with the rear bearing sleeve which is of smaller external diameter than the race and is pressed into a cylindrical socket formed in the rocker arm, 60 towards its outer end. The surface of the step between the outer race of the front bearing and the sleeve rests on and is supported by the rocker arm.

The edge of the outer end of the rocker 65 arm does not extend to any substantial degree beyond the outer edge of the outer race of the front bearing, and, further, the thickness of the rocker arm does not exceed the length of the rear bearing sleeve pressed 70 therein. This results in a saving of material and a diminution in the weight of the unit, and also in a saving in space as the housing of the unit, which must be sufficiently large to permit rocking of the rocker 75 arm about the axis of the rocker shaft, need only just clear the outer end of the rocker arm. Also, as the rocker arm is comparatively thin and has no boss formed thereon, it is possible to produce a finished 80 bearing surface along the whole length of the rocker shaft. The latter may, therefore, be surrounded and supported by the usual rocker shaft bearing substantially up to the inner face of the rocker arm, only sufficient 85 clearance between the end of the rocker shaft bearing and the rocker arm being required to permit rotation of the latter about the rocker shaft axis. This construction results in an increased rigidity of 90 structure and also in a reduction in the length of the rocker shaft for a given bearing surface.

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# 699,457 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

